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IN THE UNITED STATES DISTRICT COURT FOR THE
SOUTHERN DISTRICT OF NEW YORK

MIDWAY MANUFACTURING COMPANY:

Deposition of

vs.

Ralph Baer

THE MAGNAVOX COMPANY

SIXTH DAY

and

SANDERS ASSOCIATES, INC.

74C1030

IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF ILLINOIS, EASTERN DIVISION

THE MAGNAVOX COMPANY, et al :

vs.

BAILY MANUFACTURING
CORPORATION, et al

IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF CALIFORNIA

ATARI, INC.

vs.

THE MAGNAVOX COMPANY

and

SANDERS ASSOCIATES, INC.

FILED

OCT - 9 1976

U.S. DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

ERNEST W. NOLIN & ASSOCIATES
General Stenographic Reporters
369 ELGIN AVE., MANCHESTER, N. H. 03104
TELEPHONE: 623-6906

ORIGINAL

Continued deposition taken
pursuant to subpoena and notice at the Sanders Associates,
Inc.; Headquarters, Spit Brook Road; Nashua, New
Hampshire; Wednesday, January 7, 1976; commencing at
9:30 in the forenoon.

PRESENT:

For Midway Manufacturing
Company, Bally Manufacturing
Corporation and Empire:

Donald L. Welsh, Esq., and
A. Sidney Katz, Esq., 135 South
LaSalle Street, Chicago,
Illinois.

For Atari, Inc.:

Thomas O. Herbert, Esq.,
160 Sansome Street, 15th Floor,
San Francisco, California.

For Sanders Associates, Inc.,
and Magnavox Company:

James T. Williams, Esq.,
77 West Washington Street,
Chicago, Illinois.

For Sanders Associates:

Richard I. Seligman, Esq.,
Daniel Webster Highway, South,
Nashua, New Hampshire

For the Magnavox Company:

Thomas A. Briody, 1700 Magnavox
Way, Fort Wayne, Indiana

Stenotype Reporter:

Ronald J. Hayward

RALPH BAER

called as a witness, having been previously sworn, was further examined and continued his testimony as follows:

MR. WEISH: I'd like first to ask about the scheduling for next week. There seems to be some question about how long the depositions are going to take. When do you expect that to be resolved because we have some scheduling of our own if there are only going to be two days.

MR. WILLIAMS: I understand as of right now, as far as I can tell, they will be going through approximately one o'clock on Friday afternoon. They may not all be with Mr. Bushnell, they may be with other representatives of Atari. As you just heard Mr. Herbert and I talking, there is some doubt as to just what will happen, but I think we will have it resolved promptly.

MR. WELSH: Promptly when, today or after we get there?

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MR. WILLIAMS: I think the intention of Magnavox and Sanders is to continue until one o'clock on Friday and you can plan on that.

MR. HERBERT: This goes beyond your three-day week.

MR. WILLIAMS: I realize that.

MR. HERBERT: How come when I travel we have a day's travel in each direction and we work a three-day week; and when we go to my territory, we work a four-day week?

MR. BROIDY: There are more guys that get inconvenienced when we go out to the West Coast than when we come here.

MR. WILLIAMS: We can do it in Chicago, if you like; we will be happy to. We have one preliminary matter, last night Mr. Baer saw for the first time the transcript of his prior deposition and he has found it to be just filled with errors. He tells me that practically every sentence or every line has at least a few errors in it and we expect that he will have to make some rather massive corrections to the transcript

just to make it conform to what occurred at the deposition; and we just want to let you know that that is going to have to happen. I have not looked at the transcript myself, I am speaking from Mr. Baer's representations to me.

MR. WELSH: I haven't gone over it in detail, I did notice a few pages right at the end of the last session and I similarly found a considerable number of errors. I guess the only thing we can do is follow the normal procedure for the witness to note the corrections which he thinks ought to be made. If we agree to them, they can be made. If we don't, then the reporter will file it as transcribed.

MR. WILLIAMS: Well, I think we will have to just follow the rules, but I just wanted to let you know that we do see some problems with the transcript.

MR. HERBERT: Do you have some idea of the nature of those errors, are they in form or substance?

THE WITNESS: Yes, I believe the court reporter is having trouble in following

my diction. In many cases punctuation is omitted which is necessary to clarify the intent of the sentence and it makes the sentence virtually unintelligible ^{due} ~~as~~ to the omission of punctuation. In many cases, technical words are misspelled and in quite a number of cases I was simply misunderstood and words which sound like the word I used are shown. Looking at them in the context, they are obviously wrong and I am confident that I can correct them so that the record will be essentially that which really transpired in this room. I will say, though, that I spent four and a half hours last night reading the stuff and I wouldn't have spent that much time had I not been as appalled as I was by the difficulty evidently I am having getting recorded accurately and it is going to take me at least six to eight hours of working time to correct all those pages and hopefully from here on forward we can arrange things such that I don't always have to go through the record of today's deposition and tomorrow's and spend another two or three hours on those also sometime in the future.

MR. WELSH: Mr. Reporter, is

it ever a practice of your office to use magnetic tapes as a backup in technical depositions?

Q. No, I don't know. MR. WILLIAMS: Off the record.

Q. Do you recall the size of the screen?
(Discussion off the record.)

A. No, I don't.

Q. You also state RALPH H. BAER, the game project you called as a witness, having been previously sworn, was further examined and continued his testimony as follows:

Q. Mr. Baer, yesterday in discussing your earlier work with the bread board, I believe you stated that you worked with a TV set that was already in the Sanders facility, is that correct?

A. That is correct.

Q. Would you identify that TV set, please?

A. I am afraid I can't identify it any more except to say that it was a black-and-white TV set, a small portable which happened to be in the lab at the time, as I said earlier.

Q. You do not remember the brand name of the set?

A. No, I don't. I am sorry, I don't.

Q. Do you remember whether it was a U. S. or foreign make?

A. I do not.

Q. Do you know for what purpose it happened to be in the lab?

A. No, I don't know that either.

Q. Do you recall the size of the screen?

A. No, I don't.

Q. You also stated that for the TV game project you acquired a color TV set?

A. Yes, we did.

Q. Do you recall what make that was?

A. Yes, we still have the set in one of our labs, it is an RCA set. A console model, roughly 17 inch.

Q. When did you acquire that?

A. Sometime during the early period of the chroma work which we began to read into here yesterday. Because there was no color set available within Sanders, we had to go outside and buy one.

Q. Who did you get the black-and-white set from?

A. I don't recall; as I said, it was a set that was sitting around the lab for one reason or another.

Q. What was the model number of the RCA color set?

A. I would have to look that up unless it happens to be in some of the documents here; I don't know that from memory.

Q. Do you know where it is located here?

A. Yes, in a room on the third floor of the Canal Street building.

Q. Would it be convenient for you to check on the model number at some time when we are recessed and give that to us during the next time?

A. Yes, I can have that number for you after lunch. We will read it off the chassis.

Q. Did anyone else work with you in the use of the black-and-white set?

A. Yes, initially Mr. Solomon worked with me.

Q. And did anybody else work with you in using the black-and-white set?

A. I don't recall that, no.

Q. Once you acquired the color set, was all work thereafter done using that set or did you also continue to use the black-and-white set?

A. I can't remember that, Mr. Welsh. I can add to that just briefly that in addition to the color set, we also used a black-and-white set, a portable set for demonstrations on various occasions.

Q. Only for demonstrations?

A. And for lab work. In fact, that black-and-white set -

two black-and-white sets were used, one of which still is located in the same room as the color set and the other black-and-white set is a personal G. E. portable that belongs to me that is in my kitchen. It is a model or size.

Q. Would you also check the model number of that?

A. The model number for the G. E. set will have to wait until I get home tonight.

Q. Were any other television sets used? That is, other than the two black-and-white sets and the RCA color set that you mentioned?

A. Yes, the set which I have been unable to identify came from the lab. It was a small set.

Q. I meant other than the sets sitting around the

A. Other than those four?

Q. There were four? It was and I really don't

A. We just named four. The first black-and-white set in the lab and the color set and the two small portable black-and-white sets. That was all.

Q. I didn't understand there were two small portables.

A. Yes, a small, I believe, RCA black-and-white set that is still in the lab co-located with the color set which I am going to look up today during the

lunch hour and the G. E. portable which belongs to me personally and sits in my kitchen. Two small black-and-white sets, one color set and one black-and-white set back in '66 or '67 which I am unable to identify as to model or size.

Q. Will you also give us the identification of the RCA portable black-and-white set?

A. Yes, I will.

Q. Did you use any sets other than the four that you have now mentioned?

A. I don't recall, we probably did.

Q. Where would those have been located?

A. In the same labs, in Canal Street.

Q. Was it common to have TV sets sitting around the lab or used in the lab?

A. No, I don't suppose it was and I really don't know why they were there; all I know is that they were brought in by technicians in the hope that some other technician might fix them and they sat around for years.

Q. Were these various sets and your use of them in connection with the development of TV games modified in any manner?

A. Yes, at various times we reached into the first video amplifier of the color TV set and applied video signals directly through it rather than going through the antenna terminals via carrier, but outside of that we made no modifications to the sets.

Q. Did you make that modification in connection with all of the sets?

A. No, only in connection with the color set.

Q. Now, you stated that the only modification was to apply the video signals directly. Did you ever disable the RF stages so that the set could operate as a television receiver?

A. Yes, when I said that we entered the first video directly, that implied that we disconnected the second detector or some parts of the second detector which by definition disables anything that goes before it; namely, the IF, the tuner.

Q. Did you subsequently reconnect the second detector?

A. Yes.

Q. Did you just make that modification once or did you do it frequently?

A. I don't recall, Mr. Welsh.

Q. Could you have applied the video signal directly without disconnecting the second detector?

A. No, normally you cannot do that because the detector being a detector rectifier would load the incoming video signal and distort it.

Q. How was it determined that Mr. Harrison would be assigned to work on the TV game project?

A. Well, to the best of my recollection, he was an available senior technician at the time and he got assigned to the job.

Q. Who made the assignment?

A. Again I can only guess, but it would have been proper for me at the time to have gone to the department manager for electronic design and have asked him to have someone within his department assigned to the job.

Q. You don't remember what actually happened?

A. No, I do not.

Q. Now, were there any documents showing the modification to the color TV set that you just discussed?

A. I don't recall unless we come across them in the papers before us.

Q. Now, you stated you probably went to the department manager of electronic design and requested someone, did you have specific authorization to do that?

A. I was the division manager and I had discretionary authority to assign people to overhead assignments, which this was in the beginning.

Q. Now, was this in conjunction with the request indicated in Exhibit 9-25 in December of 1966?

A. I would have to guess again, but since that date precedes Harrison's coming on stream by quite a few months, I must have been funded at the time that he came on, so he would have actually been assigned to a job run under an I R & D task number. Either the number on this document, NDB, or a subsequent task number. We should be able to tell from looking at his papers.

Q. Which papers do you mean?

A. His lab notes which we were looking at last night.

Q. Exhibit 23?

A. Exhibit 23.

Q. Could you look at those and see if there is anything there that would help you answer the question?

A. Yes. Yes, the first indication of the task he was

working on is on document 23-43 dated 6-7-67, the task code he lists on the top of the page is NFGAA, which evidently is the task code that succeeded NDB which I started in December of '66.

Q. Did the assignment of a task code NFGAA subsequent to NDB indicate that the NDB task or project had been completed?

A. It indicated that additional funding was provided under a new task number.

Q. Was any financial report or any progress report made with respect to the NDB - is it NDBD?

A. The reference on 9-25 is NDB-1. On the bottom half of that page it says a subtask should be identified as NDBA. I don't know if it was unless we find other papers. The first three letters are really the significant task numbers. The others are subs that have to do with cost allotments to labor or materials or some other arbitrary subdefinitions at the discretion of the program manager. Very often they are simply labeled sequentially A, B, C, D for the convenience of continuing the program and breaking it up into sequential elements.

Q. Following that system, then, in the designation which

I found on Exhibit 23-43 of NFGAA, are the letters NFG the significant letters to identify the task?

A. Yes, they are.

Q. Do you know what the AA part means?

A. Well, I don't recall how the system functioned ten years ago. At present, the fourth letter is significant also to the I R & D office and it is only the fifth letter, but I don't remember just how it worked ten years ago or nine years ago.

Q. Now, the documents thus far considered including Exhibit 16 and your testimony yesterday indicates that there was no work done on the television game project between, I believe, the 11th of February and the first part of May, is that correct, of '67?

A. That is correct, page 9.

Q. And that is consistent with your note made on page 9 of Exhibit 16?

A. Yes, sir.

Q. What was the reason that no work was done on the TV game project during that period?

A. I don't recall, Mr. Welsh. -Probably unavailability of time, since up to this point it was a side project

and carried on after hours.

Q. When the work was resumed, a technician was assigned to it, what led to the decision to resume the work?

A. I believe I answered that once before, Mr. Welch, by telling you that we thought the concept deserved more attention than part-time attention after hours and the way to do that was to assign people under controlled conditions by providing funding and a task number.

Q. Well, did anything particular happen during that period to give rise to the resumption?

A. Nothing that I recall.

Q. You just decided one day that you ought to pick up the project again?

A. No, I would imagine that I was chafing at the bit to get the operation underway and for one reason or another was unable to do anything for a period of a couple of months. I can't reconstruct my thought process because there aren't any documents at this late date.

Q. Now, we did find document 9-43 yesterday that was prepared by Mr. Harrison and dated February 19, 1967,

and you indicated you were surprised that there was such a document because of the lack of activity on the TV game project at that time. During the break since yesterday, have you had occasion to reflect upon this particular document?

A. Yes, we took a look at the document and it appears as though that ~~the~~ date should have been 2-10-68 because it represents the physical layout of a piece of work that was done. As you will see by reference to some of the schematics and block diagrams here in Mr. Harrison's notes it was done in '68 and not '67. I think it was just a slip of the pen and very clearly identifies ^{ing} the circuit from the layout of something that simply didn't exist in February of '67.

Q. When Mr. Harrison was assigned to the TV game project, where did he work - strike that. Did he work on the project full time?

A. Yes, he did.

Q. Where did he work in relation to your office?

A. We set a special room aside directly opposite the elevator on the fifth floor of the Canal Street building which was within a 50-foot run or so

from my office, the same floor.

Q. Did you work with Mr. Harrison while he was assigned to the project?

A. Yes, I did.

Q. Could you describe how you worked with him?

A. In general I would join him in the room as many times for as long a period during the day as I could get away from my primary duties. Mr. Harrison worked strictly by assignment. I would determine what was to be done next and he would attempt to execute hardware designs and fabricate bread boards in accordance with my requests.

Q. Did you consult with him every day?

A. Yes.

Q. Over approximately what period of time?

A. Several years.

Q. Starting in May of 1967, you consulted with him every day over a period of several years?

A. Yes, sir.

Q. Did you consult with him every day with respect to the TV game development?

A. Yes, as long as he was on the job under my supervision.

1 Q. How long was that?

A. Well, we would have to go back to the records to refresh my memory. It was certainly at least a year or a year and a half starting with the period in May of 1967 and then at various times throughout the years for months at a time.

2 Q. He would be reassigned to the project?

A. Yes, I would request that he be reassigned and he would be reassigned.

3 Q. You stated you consulted with him every day for several years, did you mean every day that he was assigned to work on the TV game project?

A. Yes, I did.

4 Q. So there were periods during the several years when he was not on the TV game project?

A. That is correct.

55 Q. So during those times, you did not consult with him?

A. That is what I intended to say.

56 Q. I am sorry, I understood from your answer to me that you continued your consultation. During the periods or during the first period of a year to a year and a half after May, 1967, when he was working,

on the TV game project, did you consult with him every day?

A. Yes, I did.

Q. How frequently during each day did you consult with him?

A. Quite a number of times, it varied from day to day depending on time availability.

Q. Could you approximate the average number of times, say, for the first month?

A. I don't recall, but if I were to guess at it, I'd say a minimum of an hour a day, sometimes more, sometimes considerably more depending on how much trouble we were in circuit-wise because I participated in the troubleshooting and the design.

Q. Do I understand correctly your normal procedure would be to assign tasks to Mr. Harrison and he would execute them?

A. That is right.

Q. Did you ever deviate from that procedure?

A. I don't recall, but it certainly is conceivable and it undoubtedly happened that Mr. Harrison said in effect, let's do this or let's do that and we proceeded accordingly.

Q. Did you keep any notes after Mr. Harrison began to work on the TV game project?

A. Yes, we will undoubtedly find quite a few documents here as we go along that cover the same period of time.

Q. Did you keep notes on a daily basis?

A. No, only as requirements arose, I put something down on paper such as a schematic or an idea.

Q. Yesterday we were discussing policy at Sanders with respect to keeping notebooks at the time that Mr. Harrison made the entries in Exhibit 16 and Mr. Williams this morning called our attention to a page of this notebook preceding the pages where entries are made and containing a list of instructions.

(Whereupon, a recess
was taken.)

Q. (By Mr. Welsh) Do you recall seeing these instructions back in 1967, Mr. Baer?

A. I do not recall seeing them.

Q. You have signed Exhibit 16 on many of the pages, have you not?

A. Yes, I have.

Q. And made entries in it yourself?

A. Yes, I did.

Q. Did you have occasion to read these instructions today?

A. I glanced at them.

Q. Do they accurately reflect the policy of keeping record books at Sanders in 1967 as you recall that policy?

MR. WILLIAMS: I object to the question as being vague. Whose policy are you referring to?

MR. WELSH: The policy of Sanders with respect to keeping records.

MR. WILLIAMS: The question is without foundation also.

MR. WELSH: I think he testified yesterday that he recalled a policy.

THE WITNESS: I did say that, Mr. Welsh, but I certainly do not remember reading a specific policy that far back. When I said policy, I intended - I should have used the word practice.

Q. Was there a policy?

A. There may have been, obviously we have not been able to find it looking this morning, the record of a policy - written corporate policy - prior to 1971. There might have been one, I don't recall, but it certainly was the practice to use engineering notebooks and enter as much data as possible and date the pages and get them countersigned, which we attempted to practice, although we obviously didn't always do it.

80 Q. Were any personnel of Sanders instructed to follow that practice?

A. I would say that a new employee when he was handed an engineering notebook for the very first time would have been given some verbal instructions as to what he was to put into that book.

81 Q. Would that have been a policy?

A. Again it might have been as a result of written policy, but certainly as a result of practice. A good normal business practice, a lab practice.

82 Q. What do you mean or what does the word "policy" mean to you?

A. The word "policy" means a document expressed within the company by someone in authority outlining a

procedure for taking certain steps, in this case, the procedure for maintaining notes in an engineering notebook.

3 Q. But so far as you are concerned, it had to be a written statement?

A. When I say policy, I believe I mean written policy which would have to be part of the corporate standards policy handbook that is issued to most supervisors in this company.

4 Q. And what does practice mean to you?

A. It means the standard of record-keeping or behavior, whatever was established within a group or an organization within the company.

5 Q. Whether or not written?

A. Whether or not they were written.

6 Q. Is Exhibit 16 an official notebook of Sanders?

A. Yes, it is.

7 Q. Are the instructions that appear in this notebook, then, a statement of policy of the company?

A. I can't answer that again because we haven't been able to find a reference to a policy prior to 1971.

8 Q. But this book was in existence in 1967, was it not?

A. That is correct.

Q. And these are printed instructions?

A. Yes, they are instructions.

Q. Are they printed?

A. Yes, they are.

Q. Do they not then constitute a statement of policy of Sanders at that time, 1967, with respect to keeping record books?

MR. WILLIAMS: I object, the witness has already said he doesn't know.

THE WITNESS: Furthermore, that note in the notebook to which we were referring was issued by the Electronic Countermeasures Division for use by their engineers and it is only incidental that we got ahold of a spare notebook and had Harrison use it. So the instructions of a division manager in another division to our division doesn't have anything to do with us although they might have reflected common sense procedure for keeping notes.

Q. So it was unusual for your division to have this type of Sanders notebook?

A. Yes, it was.

Q. Were other notebooks of Sanders used in your division?

A. Yes, we have a standard format of which several are present in this room.

Q. Is Exhibit 17 an example of that format?

A. Yes, it is.

Q. Why was a notebook of the Electronic Countermeasures group used in place of one like Exhibit 17?

A. I really don't remember, I would have to guess, Mr. Welsh.

Q. If it were an unusual practice, that wouldn't help you remember, would it?

A. Well, I would say in that context that the TV game job was an unusual job in the context of the everyday work. Again I am strictly guessing, but I would have to ask Mr. Harrison, but he picked this book up and I think he chose it because it is a hard bound book and because of the special nature of the job and he figured he would put his notes into something a little more securely bound.

Q. So he was the one who selected the book?

A. He selected it, I don't believe I got him the book.

8 Q. Did anybody else get him the book?

A. I don't know that.

9 Q. You might have answered this yesterday, but I would like to ask you to do so again if you did; what was the practice of keeping record books in your division in mid-1967?

A. The practice was to enter such data into the notebooks as represented reasonably significant milestones in the progress of an effort, a task. It was not the intent that the notebook reflect every minor change, every note that a technician or engineer might make in the course of a daily activity.

00 Q. Now, the instructions preceding page 1 of Exhibit 16 on the first page called for a statement describing any and all experimental activities concerned with solving problems, does it not?

A. Yes, it does.

01 Q. And does it not in instruction 5 state a requirement for a record of the results obtained including all data and calculations from experiments, whether good or bad?

MR. WILLIAMS: I object, the

document speaks for itself, if that is what it says.

102 Q. It does include that, does it not?

A. Yes.

103 Q. Now, that is inconsistent, is it not, with the practice you just stated you recall existed in 1967?

A. Yes.

104 Q. Did you ever instruct new engineers or technicians with respect to the keeping of record books at Sanders?

A. Yes.

105 Q. Did you do it around mid-1967?

A. More than likely.

106 Q. What instructions did you give them at that time?

A. To keep records of their activities such that if the need arose to use a piece of equipment after a period of time had elapsed since its construction, it would not be necessary to retrace the entire circuit to find out what that piece of equipment was meant to do, what voltages had to be applied to it, what the wave forms were in certain places. In short, generally my request was to make such

notes as to make it clear how a particular piece of gear someone might have worked on or tested or constructed functioned so that it wouldn't have to be completely retested.

107 Q. Did you tell them to include results of testing of
equipment?

A. Yes.

108 Q. Did you tell them to include data taken during
testing?

A. Certainly.

109 Q. Did you tell them to include all data taken during
testing?

A. No.

110 Q. What determined which data they were to include
and which they were not to include?

A. As I said, they were given the general instructions to put down as much data as necessary to reconstruct the functioning of a piece of equipment. Possibly the sequence of events that they took down during a design job during design decisions, but certainly no one was required to put down every last step. That is like asking me in making a calculation with multiple steps, to put down every square root or

extraction as required, they were left to their judgment.

Q. So it was left to their judgment what would be left to go into their notebook and what would not?

A. Yes, essentially.

Q. Were these instructions that you gave oral or written?

A. Oral.

Q. Was any check made to see whether the instructions were followed?

A. Well, again speaking for my own division, we had a standing rule that supervisors check the engineering notebooks of people who worked in their sections or departments to make reasonably sure that people kept adequate notebooks. That is one of the most difficult disciplines to enforce.

Q. Were you Mr. Harrison's supervisor?

A. For the purpose of TV game activity, I was.

Q. And did you check his notebook?

A. Yes, I did.

Q. He also made daily notes, did he not, at this time when he was working initially on the TV game project?

A. Yes.

117 Q. Daily notes that included information that was not
transcribed into Exhibit 16?

A. Yes.

118 Q. Were you familiar with the information that he
placed in those notes?

A. Yes, I was.

119 Q. Did you compare his entries with the information
on those notes to determine whether he included in
the notebook everything which you thought ought
to be there?

A. Well, I certainly attempted to do that.

120 Q. Did you do that?

A. Yes.

121 Q. Did your instructions to new engineers or technicians
regarding record books include the time when
information and dates were to be entered in the
record books?

A. I am sure it did, though we were at times sloppy
in responding to that requirement.

122 Q. What was the requirement?

A. The dating and signing of each page in a notebook;
for example, countersigning. I thought that is what

you asked me.

23 Q. Well, what was the requirement with respect to dating and signing?

A. That each page be signed by the individual who executed it, who put the date on that page, and that the page be countersigned by someone senior to him associated with the program.

24 Q. And when you say put the date on the page, what do you mean?

A. The date that the work was done which was described on the page.

25 Q. Were there any instructions as to when the entry was to be made with respect to when the work was done?

A. Since most of these pages reflect work on a current basis, ^{and} in fact, our entries perhaps were made within minutes or hours of work that was ~~to be~~ done or about to be done, there was only a lag of hours or minutes between the entries and the material they cover, so the date on the bottom of the page would necessarily reflect the work done on that day.

126 Q. But would it necessarily reflect the date when the

entry was made?

A. Yes, because the entry would have been made concurrent with the work or very near the time that the work was done. That is the purpose of a daily engineering notebook.

27 Q. Well, now, in the case of Mr. Harrison, he entered information on separate detached sheets and then extracted material from that and put it into the notebook, Exhibit 16, did he not?

A. Yes, he did.

28 Q. Did he also make the entries in Exhibit 16 on the same day that he entered the information on his separate sheets which have accumulated in Exhibit 23?

A. Upon consideration, I would have to agree that first of all I don't know the exact answer and, secondly, that he probably entered some of the information after the fact, having consolidated his notes and transcribed them, or a summary of them in some fashion to his notebook; but more than likely, and again I am making an assumption here, that would have happened within a day or so of the actual work that had been performed.

29 Q. But he might have made the entries in Exhibit 16
on a date different than the date that those
entries bear?

A. It is possible.

30 Q. Did your instructions to new technicians and
engineers include any with respect to when entries
were to be made in their notebooks?

A. No, because instructions, as I said, were to make
entries of important data not all data.

31 Q. I believe the question was whether there were any
instructions as to when the information was to
be entered into the record book, not what information
was to be entered?

A. I can only say that the instructions in general
were to enter the information as soon as it was
at hand and of the type which they were instructed
to enter in the book.

132 Q. Do you remember that as a specific instruction?

A. That is a common sense deduction I would have to
make from the facts.

MR. KATZ: Would you read that
last answer again?

(Whereupon, the previous

answer was read back

by the reporter.)

133 Q. Referring now to Exhibit 23, would you select from this exhibit those pages which relate to work of Mr. Harrison on May 4 or earlier? That is, May 4, 1967.

A. 23-1 and 23-2 are dated 5-2-67 and appear to be an attempt on the part of Mr. Harrison to give himself a course of self-instruction in color TV since I presume he came on the job without having had any color TV experience.

134 Q. Do those documents which you just referred to, 23-1 to 23-4, include any reference to TV games?

A. None that I see. Yes, they deal with standard color TV and black-and-white TV technical details.

135 Q. Was Mr. Harrison working on the TV game project at that time, on May 2, '67?

A. Yes, he was. I assume he was. On the 3rd of May, Mr. Harrison in document 23-5 appears to have made some notes to acquaint himself with the functioning of the Heath Kit IC-62 generator, specifically as far as the color~~ed~~ generation scheme in that machine is concerned, and appended to - on 23-6,

44

rather, he appears to have sketched out a schematic showing versions of some of the chroma phase shift generation circuits we discussed here yesterday and also showing the interconnections to the Heath Kit in various places on this schematic, so I assume he was beginning to get into the background and catching up with what had been built and done before him by myself and by Tremblay.

36 Q. Now, when you say done before him by you and Tremblay, do you mean in connection with TV games?

A. Yes.

37 Q. And does this information on Exhibits 23-5 and 23-6, then, involve chroma phase shifting as you and Mr. Tremblay developed it with respect to TV games?

A. Yes, it does.

38 Q. Now, was it, at that time, an important part of the TV game development?

A. Yes, from all we saw yesterday, my recollection now is that we spent a great deal of time learning how to manipulate colors because we thought that might be an inexpensive way of making some usable games.

39 Q. And you even, I think, noted possible hardware for

varying the phase shift to get different effects?

A. Yes, we went through that yesterday and I think we will see it again.

140 Q. Now, the question was with respect to documents in Exhibit 23 reflecting work of Mr. Harrison on or prior to May 4; you have indicated some documents dated May 2 and May 3, I will call your attention before you get to May 4 to the document 23-21; now, that bears a date of May 3, does it not, 1967?

A. Yes.

141 Q. Could you look at that and the two following documents, 23-22 and 23-23, to determine whether the latter two should be considered with 23-21?

MR. WILLIAMS: If you know, Mr. Baer.

THE WITNESS: I don't see any relationship between 23-21, 23-22 and 23-23. In fact, I don't know what 23-22 represents and 23-23 is an unrelated subject to that of 23-21.

142 Q. But you do know what 23-23 relates to?

A. Yes, I do.

143 Q. As long as we have it out, could you state that?

A. Yes, it refers to work done later in which photo

cells were used for the purpose of target shooting, rifle shooting at symbology on the TV screen, a spot on the TV screen.

44 Q. When you say work done later, how much later than May 3?

A. We will have to wait until we get to it, but possibly a month or two later. We will see the dates ^{when} we go through this exhibit.

MR. WILLIAMS: Excuse me, there is a little unclarity in my notes, are you referring to Exhibits 23-22 or 23-23?

THE WITNESS: 23-23, the gun electronics.

45 Q. I believe you just found another document, 23-20, which bears the date May 3, 1967, also?

A. Yes, we did.

46 Q. Documents 23-20 and 23-21 of May 3 are out of order chronologically in Exhibit 23, are they not?

A. Yes, they are.

47 Q. Did you obtain Exhibit 23 from Mr. Harrison?

A. Yes.

48 Q. The entire exhibit, the whole folder?

A. Well, those papers in that folder which originated

from Mr. Harrison I obtained from Mr. Harrison.

I believe there is other data in that folder originated perhaps by myself or Mr. Rutch; I don't know without looking through the entire folder.

40 Q. Was there any effort to arrange the documents in Exhibit 23 chronologically?

A. Yes.

50 Q. And was that done by you?

A. Yes.

51 Q. Referring now to Exhibit 23-20, what does that show?

A. It shows in the upper left-hand corner ^{an} ~~ad~~table multivibrator intended to put out a pulse wave form at 15,750 cycles, ^{at} horizontal line frequency. Below that, it shows a way of taking 60-cycle line signal, presumably ^a sinusoidal signal or a rectified signal, and we will come to that on 23-7, and wave-shaping it to create a trigger which in turn synchronizes or triggers a one-shot so as to derive a vertical synchronization pulse of some desired width which is summed on this schematic with the output of the horizontal oscillator. And there is a separate subschematic on here which

appears to show another way to build that horizontal sync oscillator judging from the values. Well, it is not clear, it may be either vertical or horizontal; I can't tell.

152 Q. That is on the right-hand portion?

A. On the right-hand portion. By further inspection, it shows it has values identical in some of the components to that in the upper left-hand corner, so it was another version of a horizontal sync oscillator.

153 Q. And what is shown in Exhibit 23-21?

A. 23-21 shows another schematic of a 15,750 ~~astable~~ ^{astable} multivibrator intended for horizontal sync generation and some wave forms and performance of the circuit versus battery voltages.

154 Q. Now, keeping in mind Exhibits 23-20, 23-21 and 23-5 and 23-6 and referring to page 21 of Exhibit 16, is any of the information on Exhibits 23-5, 23-6, 23-20 or 23-21 entered on page 21 of Exhibit 16?

A. Yes, it appears that 23-21 was copied into the bottom half of page 21 and it also appears that subsequent tests caused him to make some changes as shown on page 21 by the addition of a resistor

here. So my assumption is that he worked on that circuit on the 4th and made that change to trim, as he says here, trim the frequency of the multi-vibrator into closer correspondence to horizontal sync.

155 Q. Was the circuit shown in the schematic - excuse me, did you have more to your answer?

A. No, sir.

156 Q. Is any of the information in Exhibit 23-20 entered on page 21 of Exhibit 16?

A. No, sir.

157 Q. Were these circuits on Exhibit 23-20; that is, the ones on the left portion of the exhibit, in existence prior to Mr. Harrison's coming onto the TV game project or did he design them?

A. I would have to make an assumption, Mr. Welch, I believe it is accurate to say that all work prior to this coming on the job was done using vacuum tubes and that whenever we see the appearance of transistorized circuitry, it is work that he did.

158 Q. Then the circuits shown on Exhibit 23-20 were not in existence prior to his joining the TV game project?

A. I don't believe so.

159 Q. Has any of the information of Exhibits 23-5 and
23-6 been entered on page 21 of Exhibit 16?

A. 23-5 does not reappear on page 21, Exhibit 16,
nor does page 23-6.

160 Q. Now, do I recall correctly that Mr. Harrison was
to enter in Exhibit 16 information that was important
to the TV game project?

A. That is correct.

161 Q. And did you not state that the previous work that
you had done with respect to phase shifting in the
chroma generator to change color was an important
part of that work?

A. Yes, certainly.

162 Q. Why, then, was not information such as that of
Exhibits 23-5 and 23-6 regarding the phase shifting
not entered in Exhibit 16?

A. I don't remember, but I suspect we will find it
in pages later.

163 Q. You do not know at this time, though, because that
was work done prior to Mr. Harrison's becoming on
the job?

A. Well, could I offer some remarks that might put the

whole thing in context?

104 Q. Surely.

A. The specific ^{reason for} ~~game of~~ Harrison's design on-board was to create something which would be commercially feasible, which meant transistorized design for minimal parts, low cost, low battery consumption, and I believe that explains why we started right out on day one paying attention to such things as creating horizontal and vertical sync generation circuits and didn't start on the color circuits on the very first day because horizontal sync and vertical sync circuits are two basic elements in any TV game.

105 Q. Referring now to Exhibit 23-7, that is dated May 4, 1967, is it not?

A. Yes, it is.

106 Q. What is shown on that exhibit?

A. That shows in the top portion of the schematic a method of deriving vertical sync from the 60-cycle power line which is also shown on page 21 of Exhibit 16. In the middle of the page, Mr. Harrison

107 Q. Excuse me, the portion you were just describing is in what portion of the page?

A. The top portion of the page.

Q. The top third, roughly?

A. The top third. The central portion of 23-7 contains two schematics, one for a horizontal oscillator for sync generation, a version of the one we saw on 23-21. It also shows a method for combining sync, vertical sync - no, for creating a video signal from vertical sync whose position on the screen is adjustable through the use of 100,000 ohm potentiometer shown on this schematic. And finally on the bottom of the page of 23-7, a three-resistor summing ^{not} ~~that~~ work is shown, which appears to describe the summation of the output from the horizontal oscillator on this page, the vertical sync generator on the page and the video gating control circuit in the right, center of the page into a composite signal which was then applied to pin 7 of V8. These are Harrison's notes here, in Heath IG-62. That is, it indicates that this summing signal, he calls it a summing matrix, was applied to pin 7 of V8 in the Heath Kit. And, furthermore, there is a note on the very bottom of the page that says the above circuitry was assembled

and made to operate in conjunction with the Heath IG-62 as a simple device with which we could control sync and video of a black-and-white TV.

69 Q. Now, you said that the horizontal oscillator in the left, central portion of Exhibit 23-7 was a version of that shown on Exhibit 23-21?

A. Yes.

70 Q. How does it differ from that shown in 23-21?

A. It differs in the value of one of the parts.

71 Q. Which part is that?

A. A coupling capacitor to the output of the circuit which is shown as a hundred Pico-farad on 23-7 and - no, I am sorry, the difference in capacitor value is between 23-7 and page 21 of Exhibit 16. The difference between 23-21 and 23-7 is the choice of transistors. 23-21 used ~~two~~ 2N718's whereas 23-7 shows that 2N2907's were used. That is why I call it a version.

172 Q. Is either of these versions shown on page 21 of Exhibit 16?

A. No, only the version ~~is~~ using the PNP transistors on page 23-7 is reproduced on page 21 of Exhibit 16.

173 Q. But the value of the coupling capacitors are

different in both of those two circuits, aren't they?

A. Yes, well, that is a trivial thing.

Q. Is there any other information on these exhibits which appears on page 21 of Exhibit 16? Just 23-7 and 23-21.

A. None that I see.

Q. The vertical sync generator does not appear?

A. It does not appear on page 21, no.

Q. Was that vertical sync generator actually used in the construction of any TV gaming apparatus?

A. To the best of my recollection, we did use it for a short while. It turned out to be very noise susceptible. That is, power line noises would bomb right through the circuit and appear in the output and very early in the game we decided to use free-running oscillators to generate vertical sync also.

Q. Is there a vertical sync generator on pages 22, 23 or 24 of Exhibit 16?

A. Yes, there are portions of a vertical sync generator on page 22 and page 23 and also page 24.

Q. Are they similar to or different from the one shown

at the top portion of Exhibit 23-7?

- A. They are similar to. In fact, the schematic on the top of page 23 appears at first glance to be very close to that shown on the top of 23-7 with the exception that he left off part of the circuit.

Q. Where did he leave off a part of the circuit?

- A. He left off the power transformer rectifier which constitutes the 60-cycle rectified source signal which is then wave-shaped by the subsequent circuit.

Q. You mean the circuit as shown at the top of page 23 of Exhibit 16 is similar to that at the top portion of Exhibit 23-7 except for omission of the transformer?

- A. Right, it appears that he was experimenting with this circuit and not only transcribed 23-7 in the book, but also ~~it~~ shows that he made changes to values of the circuit in the course of testing it.

Q. And what changes were those?

- A. Parts values. It speaks about them on page 23.

Q. In the central portion?

- A. Of page 23 of Exhibit 16.

83 Q. So that is another manner in which the sync circuit of Exhibit 23-7 was changed to that which is shown on page 23 of Exhibit 16?

A. That is correct. I assume what he was after was stretching the sync pulse so that it would also make an adequate vertical blanking pulse to blank a TV set during vertical retrace.

.84 Q. Now, going to Exhibit 23-8 which is - that is page 2 of Mr. Harrison's notes of May 4, is that correct?

A. That is correct.

.85 Q. And what is shown on Exhibit 23-8?

A. A pictorial of a TV screen with the top half identified as being - the top half of the screen identified as being black and the bottom half being identified as white and the words "brighter" and "darker" alongside. The words that accompany this sketch refer to the circuit in the right, center on 23-7 which he labeled video gating control on 23-7. And briefly it is method for generating an unblanking signal which lasts for some selected portion of an entire frame and is what you yesterday called horizontal split screen. Turning the hundred thousand ohm control on the video gate

control in 23-7 allows rolling up the borderline between the black-and-white portion of the TV presentation. He denotes, Harrison denotes that on 23-8 with a double arrow pointing both up and down.

186 Q. Now, is that circuit shown at the right of Exhibit 23-7?

A. Yes, it is.

187 Q. Was that transferred to Exhibit 16?

A. Yes, it was.

188 Q. And where was it entered in Exhibit 16?

A. On page 22.

189 Q. In the upper left portion of that page?

A. Yes, the schematic on page 22.

190 Q. Now, there are differences, are there not, between - -

A. I haven't had a chance to look at the detailed values. Yes, again in transferring the schematic from the loose sheet, 23-7, to the notebook he appears to have continued the lab work and made parts value changes as indicated by scratched-out component values and new component values and his verbal notes on the page explain what he did and what pulse widths he wound up with as a result of

making these part value changes.

MR. WELSH: This might be a good time to break for lunch, it is noon.

(Whereupon, the luncheon recess was taken.)

MR. WILLIAMS: We noticed this morning that one laboratory notebook which you examined last July, I believe it was, and subsequently received copies of was not among the documents that have been produced here today or last November and we have found out where that notebook was and recovered it and are producing it right now. And for the record, the laboratory notebook bears book No. 4555.

MR. WELSH: And the front of it also has William L. Harrison in the space labeled name and the date 5-11-67 in the space labeled issued. I would like to ask the reporter to mark this notebook as Exhibit 25. Apparently we don't have copies of all of the information here.

MR. WILLIAMS: I assume that

is correct because there are entries in September of 1975 which is after our inspection. I understand from Mr. Baer that those entries do not relate to television games. In fact, a great portion of that book does not relate to television games and the newly entered material on pages 93 through 96 also does not relate to television games, but does relate to other material included in that notebook.

MR. WELSH: Also I'd like to ask the reporter to mark each of the separate pages that have been attached to pages in this exhibit with the No. 25 followed by a dash, the number of the page to which the exhibit is attached, and that followed by a letter starting with A for the first such separate sheet and going alphabetically to other sheets where there are more than one as in the case of page 19 of this exhibit.

(Whereupon, Exhibit No. 25

was marked for identification.)

Q. Did you have a comment to make, Mr. Baer, regarding the contents of this notebook which has been marked

as Exhibit 25?

- A. Yes, the material starting on page 1 and ending on page 28 inclusive describe TV game activity. Starting with page 31 and to the end of the book, the material covered by Harrison's notebook deals with other programs totally unrelated to the TV game business.

MR. WELSH: Mr. Katz this morning during a break noticed that there were two other items that had been produced and inspected previously that were mixed with some publications that were on the window sill. One of them was apparently a notebook with a title on the back binder, the title on the outside cover was (TV) special display techniques, W. Busch, 1968 (FY1968). I believe copies of this also were produced for us, were they not, Mr. Williams?

MR. WILLIAMS: I believe so.

MR. WELSH: I would like to have the reporter mark this binder as Exhibit 26.

(Whereupon, Exhibit No. 26
was marked for identification.)

MR. WELSH: Mr. Katz also found this group of papers - off the record.

(Discussion off the record.)

MR. WELSH: A group of papers having a heading transcript of video cassette recording (side B) made in 1967 for demo to R. C. Sanders, Jr., and other senior management personnel. There are five sheets which I would like to have marked as Exhibit 27 with successive pages marked as 27-1 and so on.

(Whereupon, Exhibit No. 27 was marked for identification.)

32 Q. Referring to Exhibits 23-7 and 23-8, did you give Mr. Harrison the instructions leading to his preparation of the circuit diagrams on these pages?

A. Yes.

93 Q. What instructions did you give him?

A. To the best of my recollection, to design bread board circuits for the generation of horizontal and vertical sync and the creation of a movable unblanked pulse to create a controlled split screen

image such as that shown on 23-8.

4 Q. Do you remember giving him those specific instructions or are you assuming that you gave him those instructions after seeing these Exhibits 23-7 and 23-8?

A. I am assuming that I gave those instructions.

35 Q. Do you recall without reference to his notes giving him instructions, any instructions when he first came to work on the TV game project?

A. Yes, I believe in thoroughly indoctrinating people in a new job. I don't believe in throwing him in cold. Furthermore as a generic note to this whole upcoming stack of papers of Mr. Harrison, there isn't a circuit which we didn't discuss before it was built one way or the other because I stayed very close to the bench work. So when you ask me whether I instructed him to build something, although I cannot remember specifically what I told him, it is more likely than not that we sat and said, maybe we ought to try an emitter coupled ^{to} flipflop here or a bistable multivibrator. What I am trying to indicate is that we went to that level of detail in describing the forthcoming work.

5 Q. Did you advise him of any general objective to the
work that he was about to undertake?

A. Yes, I believe we touched on it this morning. The
general instructions were to come up with circuitry
that would lead to a commercially viable product.

7 Q. Was that objective more specific in contemplating
transistors?

A. Yes, it was specific to the extent that we did not
choose a part unless it were a low-cost part.

8 Q. And you considered transistors a low-cost part at
that time?

A. No, low-cost transistors is a low-cost part.
Transistors can vary all over the range. By
low cost, I mean transistors that are in the order
of less than 20 cents in fair quantities and
nothing but low-cost carbon resistors and composition
resistors, and similar standard electronic
components.

93 Q. Now, was this objective, then, to achieve low-cost
design of hardware for doing things that you had
done previously?

A. No, sir, let me think before I talk. I really
don't remember. We are going to have to wade through

the papers here to see just how it developed.

I don't recall whether at that moment I asked him to simply clean up and transistorize that work, which had preceded his appearance on the scene or whether we had in mind going a step further; I don't recall.

Q. Had you personally had much experience with the design of circuits using transistors prior to that time?

A. Yes, I supervised several dozens of engineers and technicians in the electronic design department for a year before I became division manager and for ten years afterwards, of which two or three had elapsed by the time this work was done.

Q. So your acquaintance with transistors was primarily supervision of engineers who worked on transistor circuits?

A. No, I ^{had} ~~have~~ done a small amount of design work incidental to some work, bench work, a few years before the TV game program.

Q. In what capacity?

A. In a capacity of a bench engineer part-time while I was division manager.

Q. So this would have been around '64 or '65?

A. It might have been.

Q. You say a small amount of design work, what did you work on?

A. Some analogue circuitry in connection with a radar altimeter. Rather ^{an FMCW} ~~FM~~ with altimeter. There may have been others, I don't recall.

Q. Did you consider yourself as the result of that work to be familiar with transistors and transistor characteristics so that you could design circuits using them?

A. Yes.

Q. Was not your initial design of DMV's for your games in December of '66 as shown on Exhibit 9-10 a design using vacuum tubes?

A. That is right.

Q. Why did you, if you knew about transistors, select vacuum tubes for that design instead of transistors?

A. Because I tried to save time by using portions of the IG-62 Heath Kit, ^{that} is a vacuum tube device, and I didn't relish the idea of interfacing vacuum tubes and transistor circuits because they are not easily compatible signal level-wise.

Q. Did Mr. Harrision use the circuits such as shown on

Exhibits 23-7 and 23-9 with the Heath Kit generator?

A. Yes, he did because we noticed that the schematics show such interfaces.

Q. So he prepared the interfaces?

A. Right.

Q. Were tubes at the end of 1966 and the beginning of 1967 more expensive than 20 cents apiece?

A. Far more expensive in the sense that they require much more supporting hardware such as filament transformers, high voltage power supplies and really totally impractical for consumer products of that vintage.

Q. Were there available any textbooks or handbooks at this time at the end of '66 and the early part of '67 dealing with interfacing of transistor circuits to vacuum tube circuits?

A. There may have been, none that I specifically recall.

Q. You do not know whether there were any at that time?

A. No.

Q. Did Mr. Harrison have experience with transistors prior to the time in May of '67 when he was assigned

to the TV game project?

A. Yes, he did.

Q. Do you know how extensive that experience was?

A. No, I don't except I can say categorically that when I arrived on the scene at Sanders in '68, 95 percent of the people had never seen a vacuum tube even at that date.

Q. I believe you said '68?

A. That is right, it will be eighteen years this summer.

Q. That would be '58.

A. Right, '58, I am sorry. Even at that time, very few people except some of the old-timers had any contact with vacuum tubes. Although the transistors were pretty bad then, all the design work was executed in transistors, so Harrison must have been engaged in transistor work for some time before he did this TV game work.

Q. So you are assuming that he was, not necessarily that he actually had previous design work with them?

A. No, I can't make that assertion definitely, no.

Q. After you discussed with him the circuits that you

wished designed and he proceeded to design them, did he consult any handbooks or textbooks dealing with a transistor circuit design, do you know?

A. I don't know.

Q. Now, you indicated you spent a great deal of time with him in his work and at his bench during this period in May, did you see him refer to any textbooks or handbooks?

A. I have no recollection of that.

Q. Are these circuit designs as shown on Exhibit 23-7 original with Mr. Harrison?

A. Mr. Welsh, these circuits are very standard circuits in the circuit design part except for the details of parts values. There is nothing very unique about them.

Q. At that time, again the latter part of '66 and early part of 1967, when you say these were standard circuits, was there some place one could go to find circuits of this design?

A. Yes, certainly basic circuits such as multivibrators are textbook circuits that you find in many texts.

Q. And were they textbook circuits at that time, at the end of '66 and early '67?

A. Yes.

Q. And so it is likely if Mr. Harrison had been working with transistors previously, he would have had these circuits already in mind from that previous experience?

A. That is correct.

Q. And did the standard circuitry at that time include interfacing between transistor circuits such as a DMV and the Heath Kit generator?

MR. WILLIAMS: I object to the question as vague. I don't understand what standard circuits are.

MR. WELSH: He referred to the circuit himself, Mr. Williams.

THE WITNESS: Well, if you mean whether handbooks described the interconnection of transistor and vacuum tube circuits, the answer has got to be yes. I could not specifically point to the book.

Q. You did not work with any such books yourself at that time?

A. No, I didn't. That is specifically a matter that you would make reference to a book for.

Q. You were familiar with the circuits, then, yourself?

A. Yes.

Q. Now, Mr. Harrison's comments on Exhibit 23-7 dated May 4, 1967, states, "The above circuitry was assembled and made to operate in conjunction with the Heath IG-62 as a simple device with which we could control sync and video of a black-and-white TV." Did you actually see him assemble and operate these circuits in conjunction with the Heath IG-62?

A. Certainly.

Q. Do you recall that from your own memory or from reading these notes in that regard?

A. No, I recall from memory that that was the case. When I saw it, on - what is the date, May 4 or sometime later - I can't recall. But sometime within a matter of days of the work being done, if not on the same day, I saw that interface being controlled by this circuit and the circuit we lifted from the IG-62.

Q. Did you not state earlier that you had contact with him every day during the time he was working on this?

A. That is right. If you want me to make an assumption,

Mr. Welsh, I saw it that day, that is all I can tell you.

Q. Well, did you state that earlier?

A. Yes.

Q. Do I understand correctly, then, that you do not have a specific recollection of seeing him assemble and operate these circuits on this day?

A. No, I do not.

Q. When I said this day, I meant May 4, 1967, the date of Exhibit 23-7; did you understand that when you answered that last question?

A. Yes.

Q. Referring now to page 21 of Exhibit 16 which is in front of you, did Mr. Harrison make that entry on page 21 in your presence?

A. I don't know that.

Q. Do you know when he made the entry?

A. The date indicates that he made it on 5-4-67.

Q. I know the page shows that date, but the question is, Do you know when Mr. Harrison made the entry on that page?

A. Mr. Harrison puts down that he made that entry on 5-4-67, I have a right to assume that he made the

entry on that date and no other date.

36 Q. So you assume that because that date appears on there, he made that entry on that date?

A. That is right.

37 Q. And you do not have any personal knowledge that he made the entry on that date?

A. The only way I could gain that personal knowledge is to hover over him every minute of the day and watch him write, which is obviously not realistic.

38 Q. So you do not have personal knowledge that he made that entry on that date?

A. Not by personal observation of the act of writing.

39 Q. Do you have personal knowledge by any other means?

A. Mr. Welsh, I said a minute ago Mr. Harrison signed the page and he signed the page because that is the date on which he made the entry. You may have a relationship of trust. There is no reason in the world why that entry should have been made on any other day other than the date he put down.

Furthermore, I signed it under the heading of witness and understood at the bottom of the page a day later.

40 Q. The date that appears after your signature is

May 5, 1967?

A. That is correct.

Q. And that is a day later than the date May 4, 1967, which appears after Mr. Harrison's signature?

A. That is right.

Q. You stated you signed that a day later, do you recall specifically placing your signature and that date on that page on May 5, 1967, or are you assuming from seeing the date on the page that that is the date on which you placed your signature and the date?

A. I am assuming it; naturally, I can't refrain from making the same comment; when I date a page, I date it on the calendar day and not some other day.

(Whereupon, a recess was
taken.)

Q. Now, when you state that you date it on the calendar day and not some other day, what do you mean by the calendar day?

A. The calendar day was generally accepted to be that day of the week and that day of the month on that particular day.

- Q. Do you mean the day on which you actually signed and placed the date was the date?
- A. Yes, sir.
- Q. Now, in this very same book, in the first four pages your signature appears with the date 1 September, '66, does it not?
- A. Yes, it does.
- Q. Now, you did not place your signature on those pages on 1 September, '66?
- A. No, I did not.
- Q. You placed them on there sometime, I believe you stated, in May of 1967?
- A. When the book was first started, right.
- Q. Is it possible that the book was started at even a later date than May of 1967?
- A. No, sir.
- Q. Now, on pages 5 through 8 of Exhibit 16 you also signed your name and placed the dates 11 February, '67, or 12 February, '67, did you not?
- A. Yes.
- Q. You also placed your signature and those dates on those pages later and at the same time that you signed and dated pages 1 through 4, did you not?

A. Yes.

Q. Did you have any regular procedure which you followed when you signed page 21 of Exhibit 16?

MR. WILLIAMS: Regular procedure for what?

MR. WELSH: Did he do anything before he signed his name, for example?

THE WITNESS: Certainly.

2 Q. What did you do?

A. Read the page.

3 Q. Did you do that with respect to each of the pages following page 21 where your name appears in the section witnessed and understood?

A. Yes.

4 Q. Did you ever deviate from that practice?

A. I apparently did in the first few pages which represent the copy of my handwritten material of 11 February and 12 February, '67.

55 Q. Why did you say that you did deviate from that procedure?

A. Because I signed those pages and put the date 1 September, '66, and 11 and 12 February, '67, next to those pages and those pages represent Harrison's

transcription of handwritten material I had prepared on those dates, but certainly those pages were handwritten by Harrison at a much later date; namely, in May of '67.

Q. I believe the practice we were discussing was that before you signed a page, you read the material on it?

A. That is right.

Q. Are you saying you did not follow that procedure with respect to pages 1 through 8?

A. Yes, because it is an unusual situation in that he for convenience sake copied out in his own handwriting stuff that I had generated months before and for some damn reason I put the same date as that of the original documents on the bottom here.

Q. Also I believe my question was with respect to the pages following page 21 rather than any pages preceding it.

A. I believe, Mr. Welsh, you asked me whether there had been any deviation from that practice following page 21 and I answered that by saying that there were deviations prior to page 21 and I had not

finished the answer. I believe, to the best of my recollection, there should be no further material in here in which there isn't - in which the standard procedure hasn't been followed.

Q. And what standard procedure are you referring to?

A. The signing of the name and date on the day, the calendar date of that day at the bottom or top of the page.

Q. Now about the procedure of reading the material on the page prior to signing your name to the page?

A. I don't understand the question.

Q. Did you ever sign your name on any of the pages following page 21 without first reading the material on that page?

A. No, sir.

Q. Were there any times when you were in a hurry, perhaps, and just scanned the page quickly rather than reading it carefully?

A. I'd say that is a fair assumption.

Q. Is it likely that happened more times than it did not?

A. Well, it is likely to have happened on occasion simply because I was very familiar with the material being put in the book in the first place.-

Q. During this period of May-June-July of 1967, were you away from your office for any extended periods?

A. I don't recollect the traveling I did in those days.

Q. Were there any times when you were away for a few days and then returned and reviewed what Mr. Harrison had done?

A. It is possible; I don't remember.

Q. Did you ever do that and then sign these pages using the same date that Mr. Harrison had put on?

A. No, there would be no reason to.

Q. Is there any doubt that you fully understood what was on each of these pages prior to the time you signed it?

A. No, sir.

Q. Now, referring to Exhibit 23, would you select from those exhibits those pages which relate to work which Mr. Harrison did prior to May 15, 1967?

Now, some of these pages are undated and in response to this request, if you find it helpful to refer to Exhibit 16, please do so.

A. All right, sir.

Q. To give you some guidance, I am just trying to trace here what happened from day to day - this appears to be a fairly full period of work with notes in different places - and I'd like to ask if perhaps we could handle it this way, to go chronologically either from the notebook, Exhibit 16, or to the pertinent pages of Exhibit 23 which you appear to have selected? Could we have the numbers of the pages of Exhibit 23 which you have selected in response to my request?

A. Yes, 23-9, 13 through 21.

Q. Now, after May 4, which I believe was the date of Exhibits 23-7, 8 and 10, as well as the date of page 21 of Exhibit 16, the next date of these documents, pages of the record book, is May 5, 1967, on page 22. Starting there, could you tell us what was being done by Mr. Harrison referring to that page in any of the other documents from Exhibit 23 which you have selected?

A. On page 22 of Document 16, Mr. Harrison shows a circuit and describes what it does. The circuit is a gated delay multivibrator whose purpose was

to create the split field we discussed earlier in connection with 23-8. 23-10 appears to be a sketch of the same circuit with somewhat different values that were subsequently crossed out.

Q. Now, Exhibit 23-10 also bears the date of May 4, 1967, does it not?

A. That is right.

Q. If I may interrupt you, you stated that some values that were in the diagram on page 22 of Exhibit 16 had been crossed out?

A. No, in rereading it, Mr. Welsh, I find that that is incorrect. Schematically, the two circuits are identical, but looking at the values and looking at the heading now, the schematic shown on 23-10 is ^a15 KC. one-shot.

Q. That is at the top portion of the page?

A. Right, not a vertical delay multivibrator. It is exactly the same circuit, but different part values. It misled me. So 23-10 has no relation to page 22 of Exhibit 16.

Q. I do notice, however, on page 22 of Exhibit 16 that there have been values of certain elements of the circuit which have been crossed out and other

values substituted, is that correct?

A. That is correct.

Q. Do you know who entered the values, crossed them out and then entered others?

A. Mr. Harrison.

Q. Do you know when that was done?

A. In the course of the bench work ~~at~~ which he describes on the same page. In fact, he describes that duty factors were too short and that he will try for other duty factors, which is a verbal way of saying "I am going to change some of the components" which he did. *

Q. Where did you find that?

A. To the right of the schematic on page 22. He says "we'll try for 20 percent to 30 percent duty factor," and then follows some numbers that are representative of an actual time period for vertical field. Some calculations of RC time constants. *

Q. Do you know whether those changes were indicated on that page by having some values crossed out at the time that you signed your name to the page?

A. That is a logical conclusion, Mr. Walsh.

Q. Well, I notice that the next page, No. 23 of

Exhibit 16, bears the date May 8, 1967, which is three days later than page 22 and yet that there is another exhibit, 23-9, prepared by Mr. Harrison bearing the date May 7, 1967; would that not indicate that Mr. Harrison was working on this project on May 7 between the dates of May 5 and May 8 and therefore - would it not indicate that?

A. Yes, indeed.

Q. And would it not be possible, then, that he might have made these changes on page 22 subsequent to May 5?

A. It is possible that on occasion because a circuit doesn't function correctly some parts were changed and the technician or engineer might reach into earlier pages and change it so that in the future he wouldn't have misleading information there, that is possible.

Q. Did your instructions with respect to entering data in record books; that is, those instructions you gave to new engineers or technicians who came to work in your division, include any with respect to making changes on previously entered information?

A. We specifically discouraged it, but it does happen.

- Q. Were any instructions given as to what to do in the event a change was made?
- A. Yes, date the change or indicate it was a revision.
- Q. What was the use to which the DMV shown on page 22 of Exhibit 16 was intended to be put?
- A. To create a vertical split field.
- Q. I am sorry, you answered that earlier.
- A. Yes.
- Q. And was that circuit subsequently used for that purpose?
- A. Yes, it was.
- Q. In answering the question, did you refer to any other document?
- A. Yes, I did, I looked at 16-31A dated 5-15-67, which is an overall schematic incorporating those circuits we have just discussed and some others.
- Q. And the circuit that we just discussed, was that shown on page 22 of Exhibit 16 which was a gated DMV to create the split field of Exhibit 23-8, is that correct?
- A. That is correct.
- Q. Where on Exhibit 16-31A does that gated DMV appear?
- A. To the left of center and roughly center with respect

to the vertical under the heading V-PDMV, which stands for vertical pulsedelay multivibrator.

Q. Could we proceed now to - strike that. Are any of the circuits on page 21 of Exhibit 16 present in the schematic diagram 16-31A?

A. Yes, the uppermost of the two schematics showing the method of deriving vertical sync from a power line reappears on 16-31 on the left-hand side center with some modifications.

Q. Of what nature are the modifications, changes in the element values?

A. Also changes in the manner in which he developed a sharp short rise time trigger from the 60-cycle sine wave across the transformer secondary.

Q. Does the other circuit of page 21 of Exhibit 16 appear in Exhibit 16-31A?

A. Yes, it is the horizontal oscillator shown on 16-31A at the top of the page somewhat to the left of center labeled 15,735 horizontal oscillator. That circuit is also the same as that shown on 23-21.

Q. Referring to the drawing again 16-31A and Exhibit 23-21, there are differences, are there not, between the

two oscillators?

A. Yes, the later schematic; that is, 16-31A, shows a resistor which is labeled 3 megohms, ^a ~~trim~~ ^{may} ~~0.631A~~, which was evidently used to trim the frequency closer to the desired 15,735 cycles, and there is also a minor difference in the value of the coupling capacitor at the output of the horizontal oscillator.

Q. And how about the types of transistors?

A. You are right, he changed from 2N718's to two 2N2907's because somewhere during the week he must have decided to work with - - - Oh, I see, evidently he needed an inverse polarity output wave form, so he ^{chose} ~~slows~~ PNP instead of NPN transistors to invert the ^{put} ~~output~~ voltage with respect to ground.

Q. Is that a major change or a minor change?

A. It is a minor change.

Q. Do you know why he needed an inverted output voltage?

A. I assume that the retrace gate which was designed several days - in that same period of time - went through several modifications and eventually wound up at a design with a positive going input and he had a negative one and he had to change it.

The retrace gate I am talking about is on 23-9, shown on 23-9, essentially the same way it appears on 16-31A. There is also a schematic on 23-10 of the same retrace gate. That is right, done three days earlier on 5-4-67; and in Exhibit 16 on page 26 is another schematic dated 5-9 where he evidently transferred the information from 23-9 to page 26 of Exhibit 16.

Q. Are you referring to the upper portion or the lower portion?

A. The upper portion of page 26.

Q. Now, from Exhibit 23-9, it appears that that circuit was designed on May 7, 1967, the date of that exhibit, does it not?

A. No, sir, from Exhibit 23-10 which is out of sequence chronologically, it appears as though he first built it or at least built it on the 4th as shown by the second schematic on that page and then drew it up more neatly and used it again three days later as shown in 23-9 and again on page 26.

MR. NELSON: Could I have that answer back, please?

(Whereupon, the previous
answer was read back
by the reporter.)

- Q. Does page 26 indicate any changes of that circuit over what is shown on Exhibit 23-9?
- A. No, it doesn't appear to.
- Q. And that is the same as the one on 23-10 as you have indicated?
- A. Yes. In fact, it becomes clear in looking at 23-10 what happened. There are the words "need a gating circuit" in Harrison's handwriting, and an ~~And-gate~~. So I assume what he did ^{is}, having expressed the need, he proceeded to quickly sketch an and gate as shown on 23-10 and then proceed to build that and-gate and proceed ^{ed} to use it; and together with the summing amp which he designed in the interim, and then recorded both the schematic of the and-gate and the interconnection to the summing amp three days later on 23-9 on the 7th of May.
- Q. And did he not two days later on May 9 enter the same information on page 26 of Exhibit 10?
- A. Yes, in addition to that, on that page, Mr. Walsh,

he added the schematic of the summer that also appears on 23-9.

Q. That is at the bottom half of that page 20?

A. Yes, sir.

Q. What does the retrace gate or what did it do?

A. It produced a split screen.

Q. By itself?

A. Let me be careful and make sure that I answer that correctly. No, not by itself, in conjunction with the vertical pulse delay multivibrator, which we identified previously on 16-31A and on page 22 of Exhibit 16. I believe I just found a still earlier schematic of that same pulse delay multivibrator, 23-20, dated 5-3-67 which shows an earlier and somewhat different version of a vertical pulse delay multivibrator. I think it would have to be paired up with 23-21 of the same date on which a horizontal oscillator is shown which we already identified as reappearing in 16-31A at the top of the page.

Q. And that appeared on page 21 of Exhibit 16 at the bottom, did it not?

A. That is correct, it is there also.

Q. Is the term "retrace gate" a common term?

A. No.

Q. Was it at that time?

A. No, but it makes sense because it describes a circuit function wherein you take a pulse lasting essentially for the duration of the retrace period and use it as a gating signal.

Q. Gating for unblanking?

A. For unblanking or some other function. In this case, for unblanking.

Q. Is that a horizontal or vertical retrace pulse that you were talking about?

A. A horizontal. Well, let me have a minute, I am trying to read this schematic to see just what happened. I understand it now. In order to write a succession of horizontal scan lines which are unblanked with respect to a section of the screen, an earlier section of the screen that was not unblanked, it is necessary that individual pulses ^{with} the duration of the horizontal sweep time be generated starting at a time with respect to vertical sync when the screen was desired to change from dark to light. Therefore, the circuit

Harrison built used horizontal sync or, if you will, the horizontal sync period which is also the horizontal retrace time and used that signal in the retrace gate by logically anding it to the output of the vertical pulse delay multivibrator. The output of that and gate then has the characteristics which I just described as being necessary for a succession of pulses intended to unblank a part of the screen. Does that answer your question?

Q. Well, in part. I believe you said the horizontal sync period was the same as horizontal retrace time?

A. Yes.

Q. Doesn't the horizontal sync period include the retrace time?

A. No, strictly speaking, horizontal sync is something that is transmitted - - - In a normal TV system, the horizontal sync pulse lasts only a short duration as spelled out by some industry standard, I think a microsecond or something; whereas, the horizontal sync retrace period is generally of the order of five or six microseconds or ten percent of the forward trace time and is a function of TV display sweep circuit components such as the

yoke and the deflection circuit. So, in this case, to go back to your initial question, is the retrace gate a common denominator, I would say it is not a common denominator and it is stretching things a little to call horizontal sync pulse a retrace gate.

MR. WELSH: Could we take a break for a minute?

(Whereupon, a recess
was taken.)

Q. I don't believe my question compared a horizontal sync pulse period with horizontal retrace time, but rather the horizontal sync period which would be the time between the horizontal sync pulses.

A. I misunderstood you. To me, horizontal sync period means the period during which horizontal sync itself lasts, not the interpulse period; that is, the period between two successive horizontal pulses, that is the basis of our misunderstanding.

Q. There are other components of the schematic of Exhibit 16-31A, are there not, which we have not discussed thus far?

A. Yes, there are. The entire lower portion of 16-31A reading from left to right hasn't been discussed yet.

Q. Do those other portions appear in these documents which you have selected from Exhibit 23 or on the pages of Exhibit 16 leading up to page 31?

A. Yes, they do in both cases.

Q. Could you point those out?

A. Not necessarily in order, Mr. Welsh, 23-6 appears to be a schematic in which Harrison redrew some of the vacuum tube circuitry we discussed this morning or yesterday in connection with the color generation. Yes, there is a date 5-3 in the upper right-hand corner, so it appears that he was considering what had been done on his first day on the job. From that, you can trace a path through 23-14 where he sketched some phase relationships which are related to the operation of the phase shifter used for varying the color phase. And then on 23-15 where he appears to have either redrawn or - yes, redrawn the circuitry of 23-6 with some variations and a detail of the phase shifter in particular onto 23-16 which also contains additional details of what

looks like, appears to be experimental work done on the phase shifter circuit. On to 23-17, more of the same with some detailed calculations of voltages and currents. Finally on to 23-18 which shows the overall system of horizontal and vertical sync generation. Vertical delay multivibrator, pulsating circuits, all combined with the color generation circuitry which appears on 23-18 in the upper right-hand corner and describes a U-shaped path going from left to right at first and then from right to left below. And that appears to be the same circuitry as that shown in 23-13 and also in document Exhibit 16, page 29. On that page, three days later on the 12th of May, he recorded the - some details of the phase shifter itself which are identical to those of 23-16. He also shows the gating circuitry required to produce a chroma signal which is similar to that shown on 23-16 and 23-17 except for the omission of a driver amplifier which was added - well, at least in one instance to the bottom of 23-16 in a small schematic near the bottom of the page and then reappears in 23-18, the same circuit.

It is also shown in 16-31A under the heading color gate diode driver.

Q. I notice that Exhibits 23-13 through 23-16 are stapled together, did you staple those together?

A. I assume so; I don't recollect specifically.

Q. Of that group, only the first page, 23-13, has a date, does it not?

A. That is right.

Q. And that date is May 3, 1967?

A. That is right.

Q. Now, do I understand correctly that the information in that group of papers which relates to the bottom portion of the schematic, 16-31A was recorded on page 29 of Exhibit 16?

A. Two of the circuits which are part of 16-31A appear on 29, page 29.

Q. One of those is the color gate diode driver on Exhibit 16-31A?

A. That is right.

Q. And is that in the lower right portion of page 29 of Exhibit 16?

A. No, the lower left portion.

Q. The lower left portion?



- A. Yes.
- Q. Now, could you point out where the phase shifter circuit is on Exhibit 16-31A?
- A. At the center near the bottom of the page. It is the circuit containing the ^N23916 transistor and a second unidentified transistor right in the middle of the page. *
- Q. And what is the portion of the circuitry to the left of that?
- A. An oscillator. A crystal oscillator running at a frequency close to the customary chroma frequency of a color TV system, 3.59 megacycles.
- Q. And that is similar to what is shown on 23-13?
- A. Yes and also Exhibit 16, page 27.
- Q. Now, the phase shifter of 16-31A is shown in 23-16, do I have that correct, in the center?
- A. Yes, that is right, in the center to the left on 23-16.
- Q. Is that also shown on any of the pages of Exhibit 16?
- A. Yes.
- Q. Where is that?
- A. On page 20, the top schematic.
- Q. Now, what is shown on 23-17?

- A. The portion of the circuit which shifts the output of the circuit from a reference chroma signal to a phase shifted chroma signal.
- Q. The output of what circuit?
- A. Of the chroma circuit or the chroma oscillator circuit.
- Q. Does that portion of the circuit on 23-17 have a name by itself?
- A. Not on 23-17, but only by inference to 16-31A where we describe the circuit as being driven by a color gate driver and down below identifying the two switching diodes as the color gate and the reference gate diode respectively. I am assuming that we call that whole circuit the color gate because that is really its function.
- Q. And that is found at the bottom, left portion of page 29 of Exhibit 16, is it not?
- A. That is right.
- Q. Now, Exhibits 23-14 through 23-19 do not have any dates on them, do they?
- A. No, they do not.
- Q. But do I understand correctly that most of the circuits shown on those pages were ultimately a

part of the schematic of Exhibit 16-31A?

A. That is correct.

Q. Are any of the portions of the schematic of Exhibit 16-31A incorporated in Exhibit 24?

A. No, sir.

Q. Were the circuits of the schematic of Exhibit 16-31A ever built?

A. Yes.

Q. Was the entire apparatus of 16-31A ever built?

A. Yes.

Q. Is that apparatus available here?

A. I believe we will find that the apparatus which is labeled No. 2 with a piece of masking tape at the other corner of this room either has some or most or all of this circuitry in it and I would have to look at it to check that out.

Q. Would you do that at this time, please?

A. Certainly.

MR. WELSH: May we first have this marked as Exhibit 28?

(Whereupon, Exhibit No. 28 was marked for identification.)

THE WITNESS: Looking at the bottom of this chassis that comprises this unit, there is a series of small subread boards which are held together by solder and are interconnected. One of these is rapidly identifiable as the chroma oscillator by its crystal, trimmer capacitor and associated transistor and other relevant parts. The summer shown in 16-31A as an RCA 3015 integrated circuit is also on that subchassis right here in the upper right-hand corner from where I am looking. (Indicating) In the center portion more of the entire - - -

No, I am sorry, I am talking about this subcircuit board which contains the chroma oscillator, the summer and I would guess the color gate. No, the phase shifter, and here is the phase shift part over on this side which is the control identified as delta phi or delta phase, which is what it denotes in the lower center portion of 16-31A. Moving to the small bread board assembly above this one and connected to it by solder, I find the color gate and reference gate diodes along with an associated 20,000 ohm biasing resistor,

so I assume that one of these transistors must be the color gate driver. Yes, here it is. I don't know whether you would like me to proceed with this?

Q. Well, all I would like to know is whether the circuit elements of Exhibit 16-31A were constructed and put into a complete apparatus? I believe you stated they were and I asked you if that apparatus were available and you indicated this apparatus. Now, was just the apparatus shown in 16-31A ever constructed by itself without additional parts?

A. Yes, it was, Mr. Welsh.

Q. That is not what we have here as Exhibit 28, though, is it?

A. No, it is not, it is part of Exhibit 28.

Q. Would it be a correct statement that the apparatus of 16-31A was built as an entire apparatus and then later was broken down and portions of it were incorporated into Exhibit 28?

A. That would be correct.

Q. When was the apparatus of - just the apparatus of Exhibit 16-31A constructed?

A. It appears from what we have just gone through that

that happened in the period between 5-3 and 5-15 of 1967.

Q. And I might call your attention to a note on the top of page 32 in Exhibit 16 which says - I am sorry, on the top of page 33 dated 5-18 which says, "note first contest played." And below that has a description in Mr. Harrison's handwriting to the effect that - words are underlined - that the first contest was played between R. H. Baer and W. Harrison. Now, there appears on that page in the upper right-hand corner the words "note first contest played!" Who wrote that note there?

A. I did.

Q. When was that note written?

A. I assume a number of years later to flag that page and make it easy to get back to the page where we could find data on the first contest played.

Q. Does that note and also the corresponding note of Mr. Harrison as to the first contest being played indicate that the apparatus, the construction of the apparatus of Exhibit 16-31A was complete on that date?

A. That indicates that. It also indicates that some

additional elements were built and used to play that game.

Q. That is elements in addition to - - -

A. Elements in addition to those on 16-31A.

Q. What game was that?

A. It was a pumping game. If you will refer to page 34 of Exhibit 16, in the upper right-hand corner it shows a pictorial of a bucket on a TV screen. It also shows a dashed line going about halfway horizontally through the bucket and the words "half full" may be visible to you there. To the left of that picture is shown a pictorial of two push button switches mounted on a support base and below that a schematic of how these push button switches were interconnected. The object of the game was for two players to push the buttons repeatedly and rapidly so as to charge up a capacitor connected to the arm of each of these switches. The voltages so generated was summed together and applied to the delay multivibrator on 16-31A, the center of the page, to move the split screen line of division up or down. It was a function of who pumped fastest. Do you want more?

Q. If there is more as to how the game was played.

A. Yes, there is. An overlay was used on the screen which showed that bucket we pictorially show on page 34 which I believe was a cutout. A silhouette of a bucket was cut out from an opaque piece of paper so that you could see the level of the unblanked portion of the raster through the opening and as you pumped, that level which appeared to be a water level in the bucket moved either up or down or the bucket effectively either filled or emptied as a function of who pumped fastest; and I wouldn't be surprised if the overlay wasn't in this room some place, too.

Q. What TV set was used in the playing of that game?

A. The color TV set I referred to because I distinctly remember that we used blue water filling the bucket.

Q. Where on the DMV of Exhibit 16-31A was that signal from the capacitors which were associated with the pushbutton switches, where is that applied?

A. You could see that most clearly by reference to page 32 of the exhibit, the bottom right-hand corner shows that interconnection.

Q. In the center portion of Exhibit 10-31A appears a capital A in a circle?

A. Right.

Q. With a line leading to a connection in the A.W., is that correct?

A. No, it doesn't appear to be. If you look again at the schematic on page 32, you notice that the voltage from the two capacitors is summed through the resistors labeled R3 and R4 and then are applied to the bottom end of the hundred thousand ohm potentiometer which is the same hundred thousand ohm pot appearing on 10-31A in the delayed multi-vibrator.

Q. Right, and the connection from the point A goes to the bottom end of the hundred thousand ohm resistor, does it not, in Exhibit 10-31A?

A. No, I call it the top end, the hot end. It is the top end. The significance of the A, I don't know. If it will help, Mr. Welsh, if you lifted the ground off the hundred thousand ohm pot on 10-31A and connected that end which I chose to call the top end, the bottom end of the pot to those two resistors R3 and R4 on page 32 of Exhibit 10, you

will see what I mean with respect to point A not being relevant to that interconnection.

MR. WELSH: Off the record.

(Discussion off the record.)

- Q. You have indicated that the voltages from the capacitors associated with the pushbutton switches is applied to the point of the delay multivibrator as shown in the lower right portion of page 32 of Exhibit 16 which in the corresponding circuit of Exhibit 16-31A would be the end of the 100 ohm resistor opposite to the end which is indicated with the letter A in a circle and a connection to it, is that correct?
- A. Yes, except that you said 100 ohms and it is a hundred thousand ohms.
- Q. I am sorry, a hundred thousand ohms.
- A. Yes.
- Q. Is that correct, then, with that change?
- A. Yes.
- Q. So that this connection indicated by the letter A in a circle actually was not there and appears erroneously on Exhibit 16-31A?

A. Yes, Mr. Welsh.

Q. That letter A in a circle and the connection adjacent to it were added at some time later than the date of May 15, 1967, is that correct?

A. It appears that way.

Q. Now, I believe you indicated that there was one other change indicated on this drawing with respect to the crystal oscillator, is that correct?

A. That is correct.

Q. Would you state what that was?

A. Well, it appears that I questioned whether the schematic was drawn right with respect to where the output of the crystal oscillator was taken. In the schematic, the output is taken from the high end of the tank circuit and I appear to have questioned whether it wasn't taken from a capacitive tap across the tank for impedance matching purposes.

Q. Did you cross out or place an "X" through the capacitor with a value of 180 pico-farads?

A. Yes, because had the output from the tank been derived from a capacitive divider, there would be no need for that capacitor.

Q. And after you placed an "X" over that capacitor,

did you then draw the other connection above it to a point between the two capacitors in the tank circuit?

A. Yes, sir, I did. I added the second - - - I am sorry, I added the second capacitor in pencil to show that the tank might have been tapped capacitively and that the output might have been taken from the junction of those two capacitors.

Q. When did you question this part of the drawing?

A. I don't recollect except that I recognize my handwriting.

Q. Was it sometime after the drawing was made, do you recall?

A. It must have been, but I don't recall.

Q. Do you recall whether it was in connection with your review of the development of the TV game program?

A. I don't recall, but I would assume that was it.

If you wait just a minute, I can see ^{whether} ~~what~~ the equipment here reflects the schematic as it was or as I changed it and that ought to pin it down. The inspection of the actual hardware shows that the tapped connection which I penciled in is actually

*

used on this bread board.

Q. Do you know when that bread board was built?

A. As we said earlier, that it was built during the period preceding 5-15-67.

MR. WELSH: Off the record.

(Discussion off the record.)

MR. WELSH: Why don't we adjourn at this time until tomorrow at nine-thirty.

(Whereupon, the deposition in the above-entitled matter was adjourned at 5:15 p.m.)

Ralph H. Ider
Dependent

THE STATE OF NEW HAMPSHIRE)

COUNTY OF Hillsborough) SS.

Subscribed and sworn to before me this 10th

day of May 19 76.

Marjorie E. Toppala
Notary Public

Marjorie E. Toppala

Notary Public

My Commission Expires March 19, 1980

EXHIBITS

<u>No.</u>	<u>Page</u>	<u>Description</u>
Exhibit 25	52	Harrison lab notebook issued 5/11/67.
Exhibit 26	53	Folder NKM (TVG) special display techniques.
Exhibit 27	54	Group of papers entitled Transcript of Videc Cassette Recording (Side B) made in 1967 for R. C. Sanders, Jr., and other senior management personnel.
Exhibit 28	90	Bread board No. 2.